The Greening of Development Economics: A Survey

Allen Blackman, Mitchell Mathis, and Peter Nelson

January 2001 • Discussion Paper 01-08

Resources for the Future
1616 P Street, NW
Washington, D.C. 20036
Telephone: 202–328–5000
Fax: 202–939–3460
Internet: http://www.rff.org

The Greening of Development Economics: A Survey

Allen Blackman, Mitchell Mathis, and Peter Nelson

Abstract

Although ignored for decades, environmental issues now attract considerable attention in the literature on economic development. This paper describes research on environmental issues in seven topic areas that historically have been at the heart of development economics: the role of the state, economic growth, trade and industrialization, relations between rich and poor countries, structural adjustment and stabilization, population change, and the objectives and strategies of development.

Key Words: environment; development; economics; literature review

JEL Classification Numbers: B20, N01, O1, O13, Q20

Contents

The Greening of Development Economics: A Survey

Allen Blackman, Mitchell Mathis, and Peter Nelson*

1. Introduction

When development economics was first established as a distinct field within economics after the Second World War, it boasted a core set of issues, models, and methodologies. As the field matured, this core fragmented and several subfields emerged, many defined by the application of tools borrowed from other areas of economics, such as trade, agricultural economics, and industrial organization.[1] Despite of this broad purview, for many years, development economists paid little attention to environmental issues. Dasgupta (1993) reports,

> [I]f there has been a single thread running through 40 years of investigation into the poverty of poor countries it has been the neglect of this [environmental resource] base. Environmental resources make but perfunctory appearances in government planning models, and they are cheerfully ignored in most of what goes by the name 'development economics.' These resources appear in the literature about as frequently as rain falls on the Thar (273).

This assessment is no longer accurate, however. In the past 15 to 20 years, economists have increasingly embraced environmental and natural resource issues, and today there is a considerable literature on 'environment and development.' In this paper, our goal is to review this evolution by drawing connections between the various branches of development economics (for example, research on trade involving developing countries) and emerging themes in the environment and development literature (for example, research on the environmental impacts of trade involving developing countries).

Our strategy is motivated by two observations. First, a fair amount of the environment and development literature has been produced by incorporating environmental concerns into ongoing research in the various subfields of development economics. Therefore, these subfields

* Blackman is a Fellow and Nelson is a Research Associate at Resources for the Future; Mathis is a Senior Researcher at the Houston Advanced Research Center, Center for Global Studies.

[1]For a discussion of this evolution, see Hirschman 1982.

provide a useful road map to environment and development research. Second, and perhaps more important, these subfields essentially constitute a catalog, however arbitrary, of the many facets of the phenomenon of economic development. As such, they provide a convenient way of organizing thinking about the potential linkages between economic development and the environment.

This paper does not attempt a comprehensive survey of the literature; rather it cites the literature selectively in order to illustrate key themes. It is organized as follows: The next section discusses divisions within the field of economic development. Section three draws connections between eight different branches of the literature on economic development and emerging themes in the environment and development literature. The last section sums up and concludes.

2. Principle Themes of the Economic Development Literature

Any characterization of the principle themes of the economic development literature is bound to be somewhat arbitrary. Ours is drawn from Nicholas Stern's (1989) survey of this literature. Stern argues that seven "grand issues" have motivated development economists:

- the role of the state,
- growth,
- trade and industrialization,
- relations between rich and poor countries (aid, trade and debt),
- structural adjustment and stabilization,
- population change and economic development, and
- objectives and strategies of development.[2]

In the next section, we discuss each of these areas in turn, first, briefly summarizing the main themes of the economic development literature and then reviewing the environment and

[2] Stern divides the literature into three meta-categories: (i) the "grand issues", (ii) "techniques for the analysis and reform of policy", and (iii) "markets, villages and households." Because we are interested in thematic, not methodological divisions, all of the topics in the second meta-categories (for example, computable general equilibrium models, cost-benefit analysis) are neglected here. To keep the purview of our paper manageable, we also ignore the topics in the third meta-category (for example, applied studies, the use of national household survey data, migration, sharecropping).

development literature. We split the fourth issue (relations between rich and poor countries) into two parts: aid and debt.

3. Emerging Themes in the Environment and Development Literature

The eight areas below represent broad themes of the emerging literature on environment and development.

3.1. Role of the State

Much of the pioneering work in economic development advocated a strong role for government in light of the perceived failures of domestic and international markets (Hirschman 1958; Myrdal 1957; Nurkse 1953). By the early 1980's the pendulum had swung to the opposite extreme, partly because of numerous highly visible failures of planning and state control. Economists argued persuasively that, whatever their shortcomings, domestic and international markets often work far more effectively to promote development than do governments (Bauer 1971; Little 1982). Today, although economic liberalization seems to have achieved the status of conventional wisdom among policy makers, the pendulum is swinging the other way—if only among academics (Krugman 1993).

The parallel debate in the environment and development literature concerns the appropriate role for the state in dealing with environmental degradation. That some kind of market intervention is desirable when negative externalities are involved is not much at issue; on this point, both theory and conventional wisdom agree. Rather, the debate concerns how governments should deal with pollution and natural resource degradation given a variety of characteristic constraints including limited fiscal, institutional and technical resources; minimal public pressure to act (whether because of a limited demand for environmental services or a lack of institutional avenues for voicing this demand); and a preponderance of hard-to-monitor, cash-strapped, small-scale polluters (Eskeland and Jimenez 1992; World Bank 2000).

First, Do No Harm

A portion of the literature environmental policy in developing countries concerns the reform of government polices that contribute to environmental degradation. Such reform can promote both environmental protection *and* economic growth, or at least can minimize trade-offs between these objectives (Brundtland et al. 1987; World Bank 1992). Policies that price inputs

below marginal cost are frequently targeted for reform. Examples include energy subsidies that promote inefficiency and the use of dirty fuels (Anderson and McKibbin 2000; Kosmo 1989; Reid and Goldenberg 1998), stumpage fees, subsidies, and resettlement incentives that promote deforestation (Binswanger 1989; Mahar 1989; Repetto 1988), subsidies to agricultural inputs that promote the degradation of soils and water (Repetto 1985, 1986), and polices that subsidize the overexploitation of extractive reserves such as mineral deposits and fish stocks (Stone 1997). Other so-called win-win policies include the privatization of public enterprises, which presumably enhances accountability for environmental damages and reduces waste and inefficiency, and macroeconomic stability, which facilitates rational policymaking and resource use. However, macroeconomic policy reform can interact with existing market imperfections (such as ill-defined property rights) to cause environmental damage (Mäler and Munasinghe 1996; Munasinghe and Cruz 1995).

Proactive Policies

There is less consensus on the proper role of the state in proactive environmental protection. This exceptionally broad topic encompasses several distinct issues such as the proper role for the state in trade and population policy. We leave a detailed discussion of these issues to the following sections. In this section, we consider two overarching issues: market-based regulatory instruments and so-called informal regulation.

Market-based regulatory instruments such as such pollution taxes and tradable emissions permits create incentives for pollution control and resource conservation but leave decisions regarding how much to control or conserve and how to do it in the hands of firms and farmers. Command-and-control instruments such as technology standards and emissions standards dictate these decisions. A key message of the extensive literature on environmental economics is that market-based instruments are generally preferable to command-and-control instruments because they are cost-effective and perhaps more important, create stronger incentives for clean technological change (Bohm and Russell 1985). However, this prescription may not generalize to developing countries because market-based mechanisms—particularly tradable emissions permits—require administrative or institutional resources that are not realistically available in many developing countries (Blackman and Harrington 2000; Eskeland and Jimenez 1991).

Given constraints on all kinds of conventional state-led environmental regulation in developing countries, the environment and development literature has increasingly focused on the potential for private-sector agents (such as community organizations, environmental advocacy groups, trade unions, stock markets and consumers) to assume a leading role in

pollution control. Although the precise mechanisms remain murky, considerable empirical evidence shows that such informal regulation can exert decisive pressure on polluters to cut their emissions (Blackman and Bannister 1998; Pargal and Wheeler 1996; World Bank 2000). One means of enhancing informal regulation is for the state to collect and disseminate reliable information about the environmental performance of polluting firms (Tietenberg 1998).

3.2. Growth

Since the inception of the field, development economics has focused on the process and determinants of economic growth. Following Harrod's (1939) and Solow's (1956, 1957) seminal work, much of the literature in this area uses aggregate models driven by rates of savings, capital accumulation and factor productivity. In the past 20 years, this growth literature has been revitalized by the recognition that certain types of investments—most notably, human capital, basic research and infrastructure—create positive externalities that spur "endogenous growth" (for a review, see Scott 1989). The two-way link between economic growth and environmental degradation has attracted considerable attention, from both theoreticians and econometricians.

Analytical Models

An extensive analytical literature focuses on the relationship between economic growth and the environment. Toman, Pezzy and Krautkraemer (1993) identify six branches of this literature. The first branch is comprised of papers that use one-sector dynamic representative agent models in which there is a finite natural resource and a neoclassical production technology (Dasgupta and Heal 1974; Solow 1974; Stiglitz 1974). These papers generally show that necessary conditions for a nondecreasing per capita consumption path are rapid technological progress and a high degree of substitutability between natural and built capital.

The second branch of this literature focuses on what has come to be known as Hartwick's rule (Hartwick 1977), the proposition that given certain conditions, nondecreasing consumption can be achieved by investing all rents obtained from exhaustible natural resources (Solow 1986; Mäler 1991; Asheim 1994). Many authors have questioned whether this rule constitutes a feasible policy prescription.

The third branch of this literature fleshes out the implications of the endogenous growth literature for resource use and environmental degradation (Carraro 1998; Elbasha and Roe 1996). Not surprisingly, accounting for positive externalities generally relaxes resource constraints.

The fourth branch focuses on stock effects, that is, the amenity values that natural resources provide. Many of these papers identify conditions under which natural resources are at least partly preserved when agents value stock effects (Barrett 1992; Krautkraemer 1985, 1986).

The fifth branch of this literature focuses explicitly on sustainability and includes three types of models: representative agent models, overlapping generation models and models in which built capital cannot be substituted for natural capital. The representative agent models consider the conditions required for nondecreasing utility over time (Asheim 1988, 1991; Pezzey 1989). Overlapping generation models are used to consider the extent to which private transfers between generations will ensure nondecreasing consumption over time. They generally suggest that such transfers are not sufficient to maximize intergenerational welfare (Howarth and Norgaard 1992; Howarth 1991; Mourmouras 1993). Common and Perrings (1992) and Barbier and Markandaya (1990) consider models in which markets function efficiently (externalities are internalized) but built and natural capital are not freely substitutable; as a result, in many cases, nondecreasing utility is unlikely absent market intervention.

Finally, the sixth branch of this literature includes papers by various authors who have incorporated pollution effects and environmental assets into models that do not fall neatly into any of the above five categories (Asako 1980; Becker 1982; d'Arge and Kogiku 1973; Keeler et al. 1972).

Empirical Research: Environmental Kuznets Curves

Much of the recent empirical literature on the link between economic growth and the environment examines the relationship between per capita aggregate income and measures of environmental quality. For some pollutants, evidence suggests that degradation increases at low levels of income, but declines at higher levels. Such inverted-U relationships have become known as environmental Kuznets curves (EKCs) in view of their similarity to the relationship between aggregate income and income distribution described by Kuznets (1955). EKCs have been used to bolster the argument that economic growth and environmental quality can go hand in hand (World Bank 1992).

But the question of whether and to what extent EKCs are actually observed has stirred considerable controversy (for a review, see Borghesi 1999). Evidence for EKCs is strongest for some air quality indicators but is much weaker for water quality and other environmental indicators (Cole et al. 1997; Grossman 1995; Selden and Song 1994; Shafik 1994; Grossman and Krueger 1995). EKC studies have been criticized because they typically use cross-sectional

country-level data to proxy for missing time-series data. As a result, they may simply reflect the juxtaposition of increasing environmental degradation in low-income countries and decreasing environmental degradation in high-income countries (Vincent 1997). Indeed, single-country time-series studies generally do not support the existence of EKCs (de Bruyn et al. 1998; Roberts and Grimes 1997; Vincent 1997).[3] Additionally, some researchers have pointed out limitations in the data and econometric techniques typically used in EKC studies (Carson et al. 1997; Cole et al. 1997; Pearson 1994; Shafik 1994).

3.3. Trade

Among development economists, few issues have commanded as much attention as the link between international trade and economic development. The evolution of conventional wisdom regarding this link has mirrored intellectual trends in development economics. Early thinking advocated trade protection meant to promote industrialization (Nurkse 1961; Singer 1950); the 1980's saw repeated calls for trade liberalization (Lal 1983; Little 1982); and more recently recognition has been growing that, in theory, imperfect competition and asymmetric information may undermine neoclassical policy prescriptions (Dixit 1989; Eaton and Grossman 1985; Krugman 1986).

Research on the nexus between trade and the environment blossomed briefly in the 1970's and has recently been revitalized in the context of the environment and development debate. This research is summarized by Dean (1992), Jayadevappa and Chhatre (2000), and Ulph (1994). The literature on trade and the environment focuses on four questions:

- How do individual countries' environmental policies affect patterns of trade?
- How do individual countries' trade policies affect the environment?
- How do transnational pollution problems and the regulations designed to ameliorate them affect patterns of trade?
- How do product standards affect patterns of trade?[4]

[3] But see Carson et al. 1997.

[4] Foreign direct investment, a fifth theme of this literature, is outside the scope of this paper. (See Pearson 1987 and Markusen 1997).

Effect of Individual Country's Environmental Policies on Patterns of Trade

Early theoretical literature on the implications of environmental regulation for trade generally incorporates the environment into standard trade models as a factor of production (Baumol and Oates 1988; McGuire 1982; Siebert 1985; for a review see, Copeland 1994). This literature generally cautions against imposing tariffs on the exports of countries with relatively lax environmental regulations and against harmonizing environmental regulations across countries. The reason is that in classical models, countries richly endowed with the environmental factor—that is, countries that have the capacity or willingness to tolerate high levels of pollution—have a comparative advantage in relatively pollution-intensive production. As a result, tariffs or global standards that attempt to 'correct for' this diversity are suboptimal. Classical models also imply that even though free trade also will be suboptimal as long as externalities in any country are not internalized, tariffs and global standards will usually fail to restore a Pareto optimum. Less theoretical analyses reach similar conclusions (Low and Safadi 1992; Pearson 1982).

More recent theoretical literature tests the robustness of these conclusions to alternative assumptions about market power, property rights, information, and uncertainty. It generally finds that environmental tariffs may serve strategic trade or risk-aversion purposes (Barrett 1994; Brander and Spencer 1985; Conrad 1993; Chichilnisky 1994; Kennedy 1994; Ulph and Ulph 1994).

Numerous empirical studies have attempted to estimate the impact of environmental regulations on patterns of trade (Chapman 1991; Goodstein 1997; Levinson 1996; Low 1992; Magee and Ford 1972; Rauscher 1997; Ratnayake 1998; for a review, see Jaffe et al. 1995). These studies generally find that environmental regulations do not impose great costs on industries (except in a few industries, such as mining and plastics), and therefore have very limited impacts on competitiveness and patterns of trade. Hence, like the neoclassical theoretical literature, these studies find little basis for environmental tariffs or global standards.

Effect of Individual Country's Trade Policies on the Environment

As noted above, in the 1980s, conventional wisdom regarding trade policy in developing countries, and in many cases trade policy itself, shifted dramatically from an emphasis on import-substitution-industrialization to export-led growth. Trade liberalization was voluntarily adopted by some developing countries and was imposed on others by International Monetary Fund (IMF) and World Bank structural adjustment programs.

The environmental impact of trade liberalization has been the subject of considerable debate. Some researchers have argued that, to the extent that developing countries rely on the production of primary commodities, export-oriented development strategies will lead to the over-exploitation of natural resources such as forests, top soil, water, and mineral deposits (Daly 1993; Kothari and Kothari 1993; Lopez 1994; Markandya and Richardson 1990; Mearns 1991). In theory, free trade can also generate a negative cycle of pollution, low environmental quality and low income (Copeland and Taylor 1997). Others have argued that free trade benefits the environment because it facilitates the transfer of green technologies, eliminates environmentally harmful price distortions, and, more important, promotes growth that is correlated with shifts in sectoral composition toward cleaner industries and shifts in preferences for environmental quality (Birdsall and Wheeler 1992, Bhagwati 1993; Freeman et al. 1997; Lopez 2000; Lucas et al. 1992; Radetzki 1992). Still others have argued that the links between trade policy and the environment are complex, idiosyncratic, and often second-order (Barrett 1990; Dunmore and Langley 1988).

Effect of Transnational Pollution on Patterns of Trade

Obviously, the best response to transnational pollution is for polluter countries to internalize externalities. But given national sovereignty and coordination problems, this is not likely to occur. Therefore, the question arises: Is there a role for trade policy—specifically, tariffs—as a second-best policy response to transnational pollution? Baumol and Oates (1988) find that there is, at least in theory.

A related question is, What specific impacts would various transnational pollution policies have on global trade patterns? Boero, Clarke and Winters (1991) and Hoeller, Dean, and Nicolaise (1991) survey the considerable literature on the predictions of computable general equilibrium models regarding the impact of carbon taxes on trade.

Effect of Product Standards on Patterns of Trade

Environmentally related product standards (such as standards for auto emissions standards and the pesticide content of agricultural produce) are typically more stringent in industrialized countries than in developing countries. Because industrialized countries apply such standards to imports, they may serve as non-tariff trade barriers. Although little work has been done in this area, Pearson (1982), for one, finds that environmentally related product standards only have a modest impact on trade patterns.

A closely related very controversial issue concerns trade in hazardous substances and wastes (*The Economist* 1992). Scherr (1987) recounts anecdotal evidence of the harmful impacts of such trade. Oates and Schwab (1988) suggest necessary conditions for it to be optimal. Azevedo (1982) surveys the evolution of relevant U.S. regulation and Sankey (1989) surveys relevant international regulation.

3.4. Aid

The central issue in the literature on aid is its effectiveness. Whereas some analysts argue that aid can have significant benefits (Cassen 1994; Mosley 1987; Riddell 1987), others maintain that it is generally ineffective and even counterproductive (Bauer 1971, 1984; Griffen and Enos 1970). Strong evidence to support either position is rare because it is difficult to define "effectiveness" and because the impact of aid is usually hard to isolate empirically.

Aid can be linked to the environment in several ways. First, conventional aid may have environmental impacts. In addition, aid can be explicitly targeted at environmental protection, both domestic and global. Finally, aid may be used to promote win-win policies that both enhance economic efficiency and protect the environment (World Bank 1993).

Conventional Aid

Conventional (non-environmental) aid for infrastructure projects such as roads and dams can cause substantial harm to the environment (Moore 1998; Rich 1994). In addition, aid can promote environmentally unfriendly forestry and agricultural policies (Bayalama 1994). More generally, because many aid projects and programs aim at boosting economic growth, they have been criticized by those who argue that growth is "unsustainable" (Daly 1996).

As a result of growing environmental concerns, it is now common for the approval of aid to be contingent on an environmental impact assessment (EIA). According to Cassen (1994), all major donor agencies have adopted some form of EIA process. A recent World Bank review determined that EIAs have been effective in spurring more environmentally friendly project proposals (World Bank 1997). Nevertheless, the EIA process has been criticized for failing to adequately account for the long-term costs of resource depletion, among other things (Mikesell 1992). Mikesell and Williams (1992) provide an overview of the evolution of environmental policies within the World Bank and other international lending institutions (see also, Hansen and Hansen 1998).

Environmental Aid

Environmental aid—that is, aid aimed explicitly at protecting the environment—is a relatively recent phenomenon. It increased markedly in the 1990s, both in absolute terms and as a percentage of total aid (World Bank 1997). It has been targeted at a variety of areas including industrial pollution control, natural resource management, and environmental institution building (World Bank 1993). Some researchers have questioned whether such aid outstrips the limited local institutional capacity for regulation (Connolly and Keohane 1996; Korten 1994).

International aid to targeted at global environmental problems has been justified on both normative and efficiency grounds. The normative rationale is that industrialized countries have contributed disproportionately to global environmental problems such as climate change and ozone depletion and therefore ought to contribute disproportionately to mitigating them. The efficiency rationale is that for developing countries, the marginal costs of investments in global environmental protection are likely to exceed the marginal benefits because local environmental concerns such as safe drinking water are more important, whereas for industrial countries, the opposite is true (Beckerman 1992; Oates 1990; Tobey 1993).

The question of how much developing countries should contribute to combating global environmental problems has generated considerable debate (Jordan1994; Parson and Zeckhauser 1995). Limited experience is available to guide policy. The 1990 Montreal Protocol negotiations secured developing country participation by creating a funding mechanism to provide compensation for the costs of reducing chlorofluorocarbon (CFC) emissions. However, climate change is generally perceived to be a much more difficult policy problem.

Win-win Aid

As discussed earlier, so-called win-win policies such as pricing reform and privatization of public enterprises have attracted considerable attention. Aid conditional on such reforms can therefore be used as an instrument for environmental protection (Larsen and Shah 1992; Reid and Goldenberg 1998)

3.5. Debt

Although the urgency of the problem has diminished somewhat since the 1980s, the large external debts carried by developing countries continue to be a source of concern to both lending and borrowing countries. Most of the literature on the topic focuses on policy prescriptions.

Proposals range from the once-and-for-all debt forgiveness (Krugman 1990; Sachs 1988), to less extreme market-based approaches, including interest rate reductions, debt buy-backs, the securitization of loans, and debt-for-equity swaps (Bulow and Rogoff 1991; Krugman 1988; Sachs 1989). Game theory has been used to illuminate issues of borrower-lender bargaining and the enforcement of debt contracts (Atkeson 1991; Eaton and Gersovitz 1981, Eaton et al. 1986).

The debate on the relationship between developing countries' debts and environmental degradation is politically charged and rich with hyperbole. The literature focuses primarily on the question of whether debt can have adverse environmental impacts by creating incentives for developing countries to boost exports to generate foreign exchange, and by diverting funds from environmental protection. The literature has also examined so-called debt-for-nature swaps.[5]

Drive to Export

Debt-burdened developing countries have incentives to increase export production to generate the foreign exchange needed to service debt obligations. Evidence suggests that for many developing countries, debt—along with a number of other factors (such as commodity prices and exchange rates)—influences export production (Capistrano and Kiker 1990). But as discussed in Section 3.3, there is little agreement about how increased export production influences the environment. Several researchers have described the difficulty of isolating the effects of debt on environmental degradation and have concluded that there is little evidence to establish such a link (Pearce et al. 1995; Reed 1992).

Fiscal Austerity

Indebted countries often reduce domestic spending to make loan payments. Yet the implications of these spending cuts for the environment are ambiguous. Although governments may cut funds for environmental programs, they also may cut funds for projects such as dams and highways that harm the environment (Hansen 1990; Pearce et al. 1995; Pinstrup-Anderson et al. 1987). However, cuts in infrastructure spending can contribute to environmental degradation (Reed 1992, chapters on Mexico and Thailand). Some analysts have argued that spending cuts generally have a negligible environmental effect because developing countries spend very little on environmental protection to begin with (Hansen 1990; Pearce et al. 1995).

[5] Structural adjustment programs—a common response to extended balance of payment problems—are discussed in Section 3.6.

Debt-for-Nature Swaps

Debt-for-nature swaps are agreements in which lenders forgive some debt in exchange for the debtor's commitment to convert designated territories into natural parks and wildlife preserves. Such agreements are fairly common and the associated literature is substantial (Hansen 1989).

Debt-for-nature swaps have been criticized on several counts. First, although they can significantly increase the debtor's spending on conservation, the amount by which the total debt is reduced is typically quite small (Deacon and Murphy 1997; Pearce et al. 1995). In fact, debt-for-nature swaps can actually *increase* the value of outstanding debt by increasing the likelihood that the remaining debt will be paid off, thus raising the price of secondary debt in the bond market (Pearce and Warford 1993). Also, monitoring and enforcing debt-for-nature swaps can be problematic (Deacon and Murphy 1997; Hrynik 1991; Sher 1993).

3.6. Structural Adjustment

Structural adjustment programs (SAPs) aim to correct developing countries' balance of payment, excess demand, and structural inefficiency problems. They typically involve currency devaluation, market deregulation, trade liberalization, privatization, and public spending reductions. Although some countries have voluntarily adopted SAPs, most have done so as a condition for receiving loans from the IMF, the World Bank and other aid agencies. The literature on SAPs is voluminous. According to Reed (1992), the World Bank's assessments of SAPs are the most comprehensive and exhaustive reviews available, despite the potential institutional bias. Cornia et al. (1987, 1988), Mosely et al. (1991) and Woodward (1992) also provide critical assessments. This literature generally focuses on the effects of SAPs on unemployment, income distribution, poverty, and the provision of basic social services.

As environmental issues have come to the fore, considerable effort has been devoted to assessing the impact of SAPs on the environment, mostly on a case-by-case basis. Partly because many findings are case-specific, there is little consensus in the literature. Some researchers find that SAPs have a positive net effect on the environment (Glover 1995; Munasinghe and Cruz 1995; Pearce and Warford 1993), while others find the opposite (Kothari and Kothari 1993; Stone and Hamilton 1991). Reed (1992) argues that one should not expect a consistent relationship between SAPs and the environment because environmental issues have not been systematically integrated into SAPs. Young and Bishop (1995) reach similar conclusions.

Although the net effects of SAPs on the environment are controversial, the mechanisms by which these impacts might arise are clear. The literature focuses on three pathways: changes in relative prices, poverty, and fiscal austerity. (The last topic was discussed in Section 3.5).

Changes in Relative Prices

Market liberalization changes relative prices. Some evidence suggests that rationalizing agricultural prices can benefit the environment, particularly removing subsidies on fertilizers, pesticides, water, energy, and credit targeted to the production of cash crops and the clearing of new lands (Askari and Cummings 1976; Bale and Lutz 1981; Berg 1986; Freeman et al. 1997; Repetto 1985,1986; Shively 1998). However, the overall impact of relative price changes is bound to be case-specific because it depends on which production activities are encouraged or discouraged (Cleaver 1985; Holden, Taylor and Hampton 1998; Pearce and Warford 1993) as well as the underlying sociopolitical and institutional framework (Reed 1992). (The closely related literature the environmental impacts of trade liberalization is discussed in Section 3.3).

Poverty

SAPs have been widely blamed for exacerbating poverty, if only in the short run. What is the environmental impact? The predominant view in the literature is that poverty can cause environmental degradation (Dasgupta and Mäler 1994; Leonard 1989; Spears, 1980). However, many analysts have argued that the relationship between poverty and environmental degradation is governed by a complex web of factors including the effectiveness of local markets and institutions (Jagannathan 1990; Jagannathan and Agunbiade 1990; for a review, see Durriapah 1998).

3.7. Population

Population has been an important topic in development economics at least since Malthus' (1798) famous argument that food production cannot keep pace with population growth because of the limited availability of arable land. Continuing the Malthusian tradition, one branch of the modern literature argues that the finiteness of the natural resource-base (broadly defined) implies that economic development ultimately cannot keep pace with population growth (Ehrlich 1968; Ehrlich and Ehrlich 1990; Council on Environmental Quality 1980; McNamara 1973,1992; Meadows et al. 1972). Other researchers argue that population growth spurs the technological innovation needed to overcome resource constraints (Simon 1986, 1990). A large body of work

falls in between these two extremes (for reviews, see Birdsall 1988; Johnson and Lee 1987; Kelly 1988).

Although natural resources always have played a significant role in the development literature on population, the past two decades have seen a more explicit focus on the environment. The two central questions addressed are whether population growth leads to environmental degradation, and whether environmental degradation, in turn, affects population growth.[6]

Effect of Population on the Environment

Much of the literature on the population-environment nexus focuses on whether and how population pressure exacerbates the environmental damage caused by agriculture. Population growth and coincident increases in demand for food in rural and urban areas can result in either agricultural extensification (the clearing of new lands for cultivation) or agricultural intensification (efforts to boost production on existing lands by adopting new cultivation practices). Many researchers have argued that when population growth is relatively slow, increased food demand can be met by agricultural intensification alone, but when population growth is rapid, extensification will also occur (Boserup 1965,1981; Lele and Stone 1989; Pingali and Binswanger 1984).

Both extensification and intensification can have severe environmental consequences. Extensification is associated with deforestation and desertification (Bilsborow and Geores 1994; Cleaver and Schreiber 1993; Myers 1991; Palloni 1994). Although intensification can prevent some of these impacts (Coxhead and Jayasuriya 1994) it can also contribute to soil erosion (Brown 1981, 1984; DeBoer 1989; Mortimore 1989; Pimentel 1993; Repetto and Gilles 1988; Smil 1984), nutrient depletion (Pieri 1993; Stoorvogel and Smaling 1990), destruction of the soil structure and reduced moisture holding capacity due to over-tilling (Pieri 1993; Walker 1982), pollution from chemical inputs such as fertilizers, pesticides, and herbicides (International Organization of Consumers Unions 1985; Murray and Hoppin 1992; Repetto 1985), increased

[6] For a brief review of formal models of the relationship between population growth, economic growth and the environment, see Rogers 1993.

resistance of pests (Dover and Croft 1984), salinization and waterlogging due to irrigation (Ahmad and Krutcher 1992; Joshi 1987), and reduced genetic diversity (Pino and Strauss 1987).[7]

A wide range of factors—including technological change, migration and government policy—mediate the relationship between population growth and the rural environment. In the case of technological change, dramatic increases in agricultural output have been achieved without significant environmental damage thanks to the adoption of environmentally friendly agricultural techniques such as terracing, contour plowing, and agroforestry (Brokenshaw 1983; Mortimore 1989; Mortimore and Tiffen 1994; Tiffen et al. 1994). The effect of migration on the environment depends on the form it takes (for example, seasonal versus permanent, toward frontiers versus toward established communities). Rural-urban migration may ease rural environmental problems but may also exacerbate urban ones (Bilsborrow 1992; Mink 1993). Several researchers have argued that in many cases, poorly designed policy—not population growth—has been the primary cause of tropical deforestation and other environmental problems (Binswanger 1987, 1989; Browder 1989; Bunker 1994; Repetto and Gillis 1988; Mahar 1989; Panayotou 1996). Finally, it is important to note that population growth often aggravates problems associated with environment damage such as poorly defined property rights, inadequate infrastructure, market imperfections, and poverty (Murdoch 1980; National Research Council 1986; Pearce and Warford 1993, chapter 11; Sen 1981). Therefore, it is difficult to disentangle the effects of population on the environment from the effects of other factors (Bilsborrow and Geores 1994).

Although population growth's effect on the rural environment has received the lion's share of attention in the literature, its impact on the urban environment also has been studied (Campbell 1989; Roberts 1994; Shukla and Parikh, 1996). Panayotou (1996) summarizes the empirical evidence on the link between population and the environment.

Effect of the Environment on Population

The argument that environmental degradation affects population growth is based on the idea that in poor rural families, children perform tasks that are essential for subsistence such as collecting fuelwood and foraging for food. If the rural environment becomes degraded and

[7] These adverse environmental effects can significantly reduce agricultural productivity. According to Myers 1993, 209, "environmental factors are causing the loss of almost half of the gains resulting from technology-based and other advances in agriculture."

resources such as fuelwood become more difficult to find, more child labor is required. As a result, the household can find itself in a vicious circle in which fertility, environmental degradation and poverty reinforce each other (Dasgupta 1992). Large family size coupled with a dwindling resource base also can lead to an increase in the family's discount rate, thereby promoting unsustainable economic activity (Cleaver and Schreiber 1993).

3.8. Objectives

The questions of how to define and measure economic development have sparked considerable debate. Early definitions of economic development emphasized per capita aggregate income. Today, broader definitions that take into account factors such as income distribution, meeting basic needs, environmental quality, and natural resource scarcity are the norm (Brundtland et al. 1987; Dreze and Sen 1989; Sen 1983; Stewart 1985; Streeton 1984). Efforts to incorporate the last two factors into definitions and measures of development have focused on the concept of sustainable income. (For a review, see Asheim 2000).

Following Hicks (1946), sustainable income is typically defined as the maximum consumption (income) possible in the present period given the requirement that consumption in future periods must not decrease. Variations of this definition exist. For example, Pearce and Warford (1993, chapter 4) define sustainable income as the maximum level of consumption that can be achieved without decreasing the total capital stock (productive capacity) including natural, human-made and human capital.[8] Some have argued for replacing conventional aggregate income measures (such as gross domestic product) with measures of sustainable income because the former fail to account for the depletion and degradation of natural assets and treat defensive costs (the costs of environmental protection) and restoration costs (the costs of clean up) as final consumption. Because of these shortcomings, conventional measures of aggregate income are said to provide an overly optimistic signal of economic growth (Dasgupta and Mäler 1991; Hueting 1989; Repetto 1989).[9]

---

[8] Thus, depletion of natural resources is allowable if it is associated with increases in other forms of capital. However, there may be limits on the substitutability of natural and man-made capital.

[9] It has been suggested that the treatment of defensive spending is important in industrialized countries, while issues of resource depletion and degradation are important in developing countries that depend on the exploitation of natural resources.

There has been considerable debate about how to measure sustainable income. Two distinct approaches have been advocated (Pearce and Warford 1993, chapter 4).[10] The first involves measuring a country's environmental quality and natural resource stock, placing monetary values on these measures, and using these values to adjust conventional measures of national income in some way. Repetto et al. (1989), Solarzano et al. (1991), Gilbert (1990), Sejenovich et al. (1991), and Carabias et al. (1991) apply this method to developing countries. The second approach—often called the physical accounts method—entails keeping parallel environmental and natural resource accounts denominated in physical units (for example, volume or weight) rather than in monetary units. This approach has been explored most fully in Norway and France (Alfsen, Bye and Lorenstsen 1987; Theys 1989).[11] Each of these approaches has advantages and disadvantages. The first approach facilitates comparing environmental and economic data and creating a single indicator of sustainable income. The principal disadvantage is the well-known difficulty of developing monetary values for non-priced environmental goods and services (Barde and Pearce 1991). Nevertheless, the first approach is far more popular.

Views also differ as to how to adjust conventional aggregate income accounts to reflect the use of natural assets One approach is to adjust net domestic product (NDP), which accounts for depreciation of human-made capital, so that it includes the depreciation of natural assets as well (Bartelmus and van Tongeren 1993; Pearce and Warford 1993, chapter 14). However, some researchers have argued that this approach is flawed because it ignores the permanent income that can be generated from the sale of natural assets. These researchers advocate modifying GDP directly (El Serafy 1989).

Considerable controversy also surrounds the appropriate treatment of defensive and restorative expenditures. Some analysts argue that because these expenditures are costs rather than final products, they should be deducted from conventionally calculated GDP (Daly 1989; Pearce, Markandya and Barbier 1990; Pearce and Warford 1993). Others argue that this approach is unlikely to yield useful results given the difficulties of defining defensive expenditures (Bartelmus 1992).

---

[10] See Peskin with Lutz 1990 for a slightly different categorization of methodological approaches.

[11] The French system is based on a broader concept of sustainable development that encompasses such elements as cultural heritage and includes plans for eventual monetary valuation.

Finally, there has been some debate regarding the best method for structuring sustainable income accounts. Some researchers argue that environmental data should be integrated directly into a single measure (Hueting 1980; Peskin 1988; Daly 1989). Others advocate keeping environmental data in a satellite account to preserve the statistical continuity of conventional income measures (Bartelmus 1992).

4. Conclusion

The literature summarized above is diverse and voluminous, so any attempt to draw conclusions from it will necessarily appear somewhat cavalier. That said, we argue that two overarching, closely related concerns underpin the literature: the appropriate role of government in environmental policy and the existence of significant trade-offs between economic and environmental policy objectives.

As noted in Section 3.1, mainstream thinking about the proper role of the state in (non-environmental) development policy has shifted significantly over time. Early development literature emphasized the need for government intervention to overcome market failures. Today, there is a greater appreciation of the benefits of unfettered markets and of the severity of institutional, fiscal, and technical constraints on effective state action. The literature on environment and development reviewed in this paper reflects this shift. It is characterized by a concern with balancing regulation and market forces, and with a growing recognition of the limits of most countries' regulatory capabilities.

For example, in the literature on industrial pollution control, more and more attention is being focused on the extent to which pressure applied on polluters by private sector agents can be used to shore up chronically weak state regulation. Concerns about ineffectual state regulatory institutions also have informed debates about environmental aid and debt-for-nature swaps. The literatures on trade and the environment, structural adjustment, and debt have all focused on the question of whether curtailing government control over international trade will exacerbate environmental degradation. Research suggesting that it will not has been used to rationalize trade liberalization. Finally, the literature on environmental Kuznets curves has been motivated by, among other things, concerns about the environmental consequences of limited state regulation. Evidence for U-shaped relationships between environmental degradation and economic growth have been used by some analysts to rationalize subordinating environmental protection to economic growth.

A related theme of the literature reviewed in this paper has to do with trade-offs between environmental protection and economic growth. The existence of such trade-offs makes expenditures on environmental protection much less attractive in poor countries. An increasingly common argument is that in most developing countries, there are significant opportunities to pursue win-win policies. The debate over this proposition is closely tied to the debate about of the proper role for government. Abundant win-win opportunities rationalize a limited role for government in environmental protection per se.

The most obvious evidence of this second theme can be found in the theoretical and empirical literature on economic growth, the principal preoccupation of which is the relationship between growth and the environment. In addition, the literatures on industrial pollution, population, and international aid have all devoted considerable attention to the supposed win-win policy of removing environmentally harmful subsides on critical dirty inputs such as fuels, fertilizers, and pesticides. Finally, the key concern underpinning the literature on trade and the environment is whether there is a significant trade off between environmental protection and success in the international marketplace—a proven catalyst of economic growth. The literature has focused on both the potential for more stringent environmental regulation to dampen export growth, and the potential for trade liberalization to exacerbate environmental degradation.

References

1. Introduction

Dasgupta, P. 1993. *An Inquiry into Well-Being and Destitution.* Oxford, U.K.: Clarendon.

Hirschman, A. 1992. The Rise and Decline of Development Economics. In M. Gersovitz and others (eds.), *The Theory and Experience of Economic Development*, London, U.K.: Allen and Unwin.

2. Principal Themes of the Economic Development Literature

Stern, N. 1989. The Economics of Development: A Survey. *Economic Journal* 99: 597–685.

3.1. Role of the State

Anderson, K. and W. McKibbin. 2000. Reducing Coal Subsidies and Trade Barriers: Their Contribution to Greenhouse Gas Abatement." *Environment and Development Economics* 5(4): 457-81.

Bauer, P. 1971. *Dissent on Development: Studies and Debates in Development Economics*. London, U.K.: Weidenfield and Nicolson.

Binswanger, H. 1989. Brazilian Policies that Encourage Deforestation in the Amazon. Working Paper 16. Washington, DC: World Bank, Environment Department.

Blackman, A., and G. J. Bannister. 1998. Community Pressure and Clean Technology in the Informal Sector: An Econometric Analysis of the Adoption of Propane by Traditional Mexican Brickmakers. *Journal of Environmental Economics and Management* 35: 1–21.

Blackman A., and W. Harrington. 2000. The Use of Economic Incentives in Developing Countries: International Experience with Industrial Air Pollution. *Journal of Environment and Development* 9: 5–44.

Bohm P., and C. Russell. 1985. Comparative Analysis of Alternative Policy Instruments. In A. Kneese, and J. Sweeney (eds.), *Handbook of Natural Resource and Energy Economics, Vol. 1.* Amsterdam, the Netherlands: Elsevier, pp. 395–460.

Brundtland, G., and others. 1987. *Our Common Future: Report by the World Commission on Environment and Development*. New York: Oxford University Press.

Eskeland, G., and E. Jimenez. 1991. Curbing Pollution in Developing Countries. *Finance and Development* 28: 15–18.

Eskeland, G., and E. Jimenez. 1992. Choosing Policy Instruments for Pollution Control: A Review. PRE Working Paper 624. World Bank Country Economics Department, Washington, DC.

Hirschman, A. 1958. *The Strategy of Economic Development*. New Haven, CT: Yale University Press.

Kosmo, M. 1989. Commercial Energy Subsidies in Developing Countries. *Energy Policy* June: 244–253.

Krugman, P. 1993. Toward a Counter-Counterrevolution in Development Theory. *Proceedings of the World Bank Annual Conference on Development Economics*. Washington, DC: World Bank.

Little, I. 1982. *Economic Development*. New York: Basic Books.

Mahar, D. 1989. *Government Policies and Deforestation in Brazil's Amazon Region*. Washington, DC: World Bank.

Mäler, K.-G., and M. Munasinghe. 1996. Macroeconomic Policies, Second-Best Theory and the Environment. *Environment and Development Economics* 1: 149–163.

Myrdal, G. 1957. *Economic Theory in Underdeveloped Regions*. London, U.K.: Duckworth.

Munasinghe, M., and W. Cruz. 1995. Economy-Wide Policies and the Environment: Lessons from Experience. Environment Paper 10. Washington, DC: The World Bank.

Nurkse, R. 1953. *Problems of Capital Formation in Underdeveloped Countries*. Oxford, U.K.: Blackwell.

Pargal, S., and D. Wheeler. 1996. Informal Regulation of Industrial Pollution in Developing Countries: Evidence from Indonesia. *Journal of Political Economy* 104: 1314–1327.

Reid, W., and J. Goldenberg. 1998. Developing Countries Are Combating Climate Change. *Energy Policy* 26: 233–237.

Repetto, R. 1985. *Paying the Price: Pesticide Subsidies in Developing Countries*. Washington, DC.: World Resources Institute.

———. 1986. *Economic Policy Reform for Natural Resource Conservation*. Washington, DC: World Resources Institute.

———. 1988. *The Forest for the Trees? Government Polices and the Misuse of Forest Resources*. Washington, DC: World Resources Institute.

Stone, C. 1997. Too Many Fishing Boats, Too Few Fish: Can Trade Laws Trim Subsidies and Restore the Balance in Global Fisheries? *Ecology Law Quarterly* 24: 505–537.

Tietenberg, T. 1998. Disclosure Strategies for Pollution Control. *Environmental and Resource Economics* 11: 587–602.

World Bank. 1992. *World Development Report 1992*. Washington, DC: The World Bank.

———. 2000. *Greening Industry: New Roles for Communities, Markets, and Governments*. New York: Oxford University Press.

3.2. Growth

Asheim, G. 1988. Rawlsian Intergenerational Justice as a Markov-Perfect Equilibrium in a Resource Technology. *Review of Economic Studies* 55: 469–484.

———. 1991. Unjust Intergenerational Allocations. *Journal of Economic Theory* 54: 350–371.

———. 1994. Net National Product as an Indicator of Sustainability. *Scandinavian Journal of Economics* 96: 257–265.

Asako, K. 1980. Economic Growth and Environmental Pollution Under the Max-Min Principle. *Journal of Environmental Economics and Management* 7: 157–183.

Barbier, E., and A. Markandaya. 1990. The Conditions for Achieving Environmentally Sustainable Development. *European Economic Review* 34: 659–669.

Barrett, S. 1992. Economic Growth and Environmental Preservation. *Journal of Environmental Economics and Management* 23: 289–300.

Becker, R. 1982. Intergenerational Equity: The Capital-Environment Trade-off. *Journal of Environmental Economics and Management* 9: 165–185.

Borghesi, S. 1999. *The Environmental Kuznets Curve: A Survey of the Literature*. European University Institute. Unpublished manuscript.

Carraro, C. 1998. New Economic Theories: Impact on Environmental Economics. *Environmental and Resource Economics* 11: 365–381.

Carson, R., Y. Jeon, and D. McCubbin. 1997. The Relationship between Air Pollution Emission and Income: U.S. Data. *Environment and Development Economics* 2: 433–450.

Cole, M., A. Rayner, and J. Bates. 1997. The Environmental Kuznets Curve: An Empirical Analysis. *Environment and Development Economics* 12: 401–416.

Common, M., and C. Perrings. 1992. Towards an Ecological Economics of Sustainability. *Ecological Economics* 6: 7–34.

d'Arge, R., and K. Kogiku. 1973. Economic Growth and the Environment. *Review of Economic Studies* 40: 61–77.

Dasgupta, P., and G. Heal. 1974. The Optimal Depletion of Exhaustible Resources. In *Review of Economic Studies Symposium on the Economics of Exhaustible Resources.* Edinburgh, U.K.: Longman.

de Bruyn, S., J. van den Bergh, and J. Opschoor. 1998. Economic Growth and Emissions: Reconsidering the Empirical Basis of Environmental Kuznets Curves. *Ecological Economics* 25: 161–175.

Elbasha, E., and T. Roe. 1996. On Endogenous Growth: The Implications of Environmental Externalities. *Journal of Environmental Economics and Management* 31: 240–268.

Grossman, G. 1995. Pollution and Growth: What Do We Know? In I. Goldin and L. Winters (eds.), *The Economics of Sustainable Development*. Cambridge, U.K.: Cambridge University Press.

Grossman, G., and A. Krueger. 1995. Economic Growth and the Environment. *Quarterly Journal of Economics* 110: 353–377.

Harrod, R. 1939. An Essay in Dynamic Economic Theory. *Economic Journal* 49: 14–33.

Hartwick, J. M. 1977. Intergenerational Equity and the Investing of Rents from Exhaustible Resources. *American Economic Review* 67: 972–974.

Howarth, R. 1991. Intertemporal Equilibria and Exhaustible Resources: An Overlapping Generations Approach. *Ecological Economics* 4: 237–252.

Howarth, R., and R. Norgaard. 1992. Environmental Valuation under Sustainability. *American Economic Review* 82: 473–477.

Keeler, E., and others. 1972. The Optimal Control of Pollution. *Journal of Economic Theory* 4: 19–34.

Krautkraemer, J. 1986. Optimal Depletion with Resource Amenities and a Backstop Technology. *Resources and Energy* 8: 133–149.

Krautkraemer, J. A. 1985. Optimal Growth, Resource Amenities, and the Preservation of Natural Environments. *Review of Economic Studies* 52: 153–170.

Kuznets, S. 1955. Economic Growth and Income Inequality. *American Economic Review* 45: 1–28.

Mäler, K.-G. 1991. National Accounts and Environmental Resources. *Environmental and Resource Economics* 1: 1–16.

Mourmouras, A. 1993. Conservation Government Policies and Intergenerational Equity in an Overlapping Generations Model with Renewable Resources. *Journal of Public Economics* 51: 249–268.

Pearson, P. 1994. Energy Externalities and Environmental Quality: Will Development Cure the Ills It Creates? *Energy Studies Review* 6: 199–215.

Pezzey, J. 1989. Economic Analysis of Sustainable Growth and Sustainable Development. Working Paper 15. Washington, DC: World Bank, Environment Department.

Roberts, J., and P. Grimes. 1997. Carbon Intensity and Economic Development, 1962–91: A Brief Exploration of the Environmental Kuznets Curve. *World Development* 25: 191–198.

Scott, M. 1989. *A New View of Economic Growth*. Oxford, U.K.: Oxford University Press.

Selden T., and D. Song. 1994. Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions? *Journal of Environmental Economics and Management* 27: 147–162.

Shafik, N. 1994. Economic Development and Environmental Quality: An Econometric Analysis. *Oxford Economic Papers* 46: 757–773.

Solow, R. M. 1956. A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics* 70: 65–94.

———. 1957. Technical Change and the Aggregate Production Function. *Review of Economics and Statistics* 39: 312–320.

———. 1974. Intergenerational Equity and Exhaustible Resources. *Review of Economic Studies, Symposium on the Economics of Exhaustible Resources.* Edinburgh, U.K.: Longman, 29–45.

———. 1986. On Intergenerational Allocation of Natural Resources. *Scandinavian Journal of Economics* 88: 141–149.

Stiglitz, J. 1974. Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths. *Review of Economic Studies, Symposium on the Economics of Exhaustible Resources*. Edinburgh, U.K.: Longman, 29–45.

Toman, M., J. Pezzey, and J. Krautkraemer. 1993. Economic Theory and "Sustainability. " RFF Discussion Paper ENR93-14-REV. Washington, DC: Resources for the Future.

Vincent, J. 1997. Testing for Environmental Kuznets Curves within a Developing Country. *Environment and Development Economics* 12: 417–431.

World Bank. 1992. *World Development Report 1992*. New York: Oxford University Press.

3.3. Trade

Azevedo, M. 1982. Trade in Hazardous Substances: An Examination of U.S. Regulations. In S. Rubin (ed.), *Environment and Trade*. Englewood Cliffs, NJ: Allanheld, Sosum and Co.

Barrett, S. 1990. The Problem of Global Environmental Protection. *Oxford Review of Economic Policy* 6: 68–79.

———. 1994. Strategic Environmental Policy and International Trade. *Journal of Public Economics* 54: 325–338.

Baumol, W., and W. Oates. 1988. *The Theory of Environmental Policy*. Englewood Cliffs, NJ: Prentice Hall.

Bhagwati, J. 1993. The Case for Free Trade. *Scientific American* 269: 42–49.

Birdsall, N., and D. Wheeler. 1992. Trade Policy and Industrial Pollution in Latin America: Where Are the Pollution Havens? In P. Low (ed.), *International Trade and the Environment*. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 159–168.

Boero, G., R. Clarke, and A. Winters. 1991. *The Macroeconomic Consequences of Controlling Greenhouse Gases: A Survey.* Department of Environmental Economics Research Series. London, U.K.: HMSO.

Brander J. and B. Spencer. 1985. Export Subsidies and International Market Share Rivalry. *Journal of International Economics* 18: 83–100.

Chapman, D. 1991. Environmental Standards and International Trade in Automobiles and Copper: The Case for a Social Tariff. *Natural Resources Journal* 31: 449–461.

Chichilnisky, G. 1994. North-South Trade and Global Environment. *American Economic Review* 84: 851–874.

Conrad, K. 1993. Taxes and Subsidies for Pollution-Intensive Industries as Trade Policy. *Journal of Environmental Economics and Management* 25: 121–135.

Copeland, B. R. 1994. International Trade and the Environment: Policy Reform in a Polluted Small Open Economy. *Journal of Environmental Economics and Management* 26: 44–65.

Copeland, B. R. and M. S. Taylor. 1997. The Trade-Induced Degradation Hypothesis." *Resource and Energy Economics* 19(4): 321-44.

Daly, H. 1993. The Perils of Free Trade. *Scientific American* 269: 50–57.

Dean, J. 1992. Trade and the Environment: A Survey of the Literature. In P. Low (ed.), International Trade and the Environment. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 15–28.

Dixit, A. K. 1989. Trade and Insurance with Imperfectly Observed Outcomes. *Quarterly Journal of Economics* 105: 195–203.

Dunmore, J., and J. Langley. 1988. Discussion: Conceptual and Empirical Needs for Integrating Resources and Trade Analysis. In J. Sutton (ed.), *Agricultural Trade and Natural Resources: Discovering the Critical Linkages*. Boulder, CO: Lynne Reinner.

Eaton, J., and G. Grossman. 1985. Tariffs as Insurance: Optimal Commercial Policy when Domestic Markets are Incomplete. *Canadian Journal of Economics* 18: 258–272.

The Economist. 1992. Pollution and the Poor: Why "Clean Development" at Any Price is a Curse on the Third World. February 15.

Freeman, A., T. Roe, and J. Smith. 1997. The Effects of Policies on Farming Households' Decisions: Economic Evidence and Environmental Implications in Northern Nigeria. *Environment and Development Economics* 2: 307–321.

Goodstein, E. 1997. *A New Look at Environmental Protection and Competitiveness*. Washington, DC: Economic Policy Institute.

Hoeller, P., A. Dean, and J. Nicolaise. 1991. Macroeconomic Implications of Reducing Greenhouse Gas Emissions: A Survey of Empirical Studies. *OECD Economic Studies* 16: 45–78.

Jaffe, A. B, S. R. Peterson, P. R. Portney, and R. N. Stavins. 1995. Environmental Regulation and International Competitiveness: What Does the Evidence Tell Us? *Journal of Economic Literature* 33: 132–163.

Jayadevappa, R. and S. Chhatre. 2000. International Trade and Environmental Quality: A Survey. *Ecological Economics* 32:175-194.

Kennedy, P. 1994. Equilibrium Pollution Taxes in Open Economies with Imperfect Competition. *Journal of Environmental Economics and Management* 27: 49–63.

Kolstad, C. 1997. Editor's Introduction to Special Issue on Trade and the Environment. *Resource and Energy Economics* 19: 261–266.

Kothari, M., and A. Kothari. 1993. Structural Adjustment vs. Environment. *Economic and Political Weekly* 28: 473–477.

Krugman, P. R. 1986. *Strategic Trade Policy and the New International Economics*. Cambridge, MA: MIT Press.

Lal, D. 1983. *The Poverty of Development Economics*. Institute of Economic Affairs. London, U.K.: Hobart.

Levinson, A. 1996. Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufactures. *Journal of Public Economics* 62: 5–29.

Little, I. 1982. *Economic Development*. New York: Basic Books.

Lopez, R. 1994. The Environment as a Factor of Production: The Effects of Economic Growth and Trade Liberalization. *Journal of Environmental Economics and Management* 27: 163–184.

———. 2000. Trade Reform and Environmental Externalities in General Equilibrium: Analysis for an Archetype Poor Tropical Country. *Environment and Development Economics* 5(4): 377-404.

Low, P. 1992. Trade Measures and Environmental Quality: The Implications for Mexico's Exports. In P. Low (ed.), International Trade and the Environment. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 105–120.

Low, P., and R. Safadi. 1992. Trade Policy and Pollution. In Low, P. (ed.), International Trade and the Environment. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 29–52.

Lucas, R., and others. 1992. Economic Development, Environmental Regulation and the International Migration of Toxic Industrial Pollution: 1960–1988. In P. Low (ed.), International Trade and the Environment. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 67–86.

Magee, S., and W. Ford. 1972. Environmental Pollution, the Terms of Trade, and the Balance of Payments. *Kyklos* 25: 101–118.

Markandya, A., and J. Richardson. 1990. *The Debt Crisis, Structural Adjustment, and the Environment*. London Environmental Economics Centre, London, UK. mimeo.

Markusen, J. 1997. Costly Pollution Abatement, Competitiveness, and Plant Location Decisions. *Resource and Energy Economics* 19: 299–320.

McGuire, M. 1982. Regulation, Factor Rewards, and International Trade. *Journal of Public Economics* 17: 335–354.

Mearns, R. 1991. Environmental Implications of Structural Adjustment: Reflections on Scientific Method. Discussion Paper 284. Sussex, U.K.: Institute of Development Studies, University of Sussex.

Nurkse, R. 1961. *Patterns of Trade and Development*. The Wiksell Lectures. Oxford, U.K.: Basil Blackwell.

Oates, W., and R. Schwab. 1988. Economic Competition among Jurisdictions: Efficiency Enhancing or Distortion Inducing? *Journal of Public Economics* 35: 333–354.

Pearson, C. 1982. *Environmental Policies and Their Trade Implication for Developing Countries, with Special Reference to Fish and Shellfish, Fruit and Vegetables*. NY: UNCTAD.

———. 1987. *Multinational Corporations, Environment, and the Third World*. Durham, NC: Duke University Press.

Radetzki, M. 1992. Economic Growth and the Environment. In P. Low (ed.), International Trade and the Environment. World Bank Discussion Paper 159. Washington, DC: World Bank, pp. 1–14.

Ratnayake, R. 1998. Do Stringent Environmental Regulations Reduce International Competitiveness? Evidence from an Inter-Industry Analysis. *International Journal of the Economics of Business* 5: 77–96.

Rauscher, M. 1997. Environmental Regulation and International Capital Allocation. In C. Carraro and D. Siniscalco (eds.), *New Directions in Economic Theory of the Environment*. Cambridge, U.K.: Cambridge University Press.

Sankey, J. 1989. Domestically Prohibited Goods and Hazardous Substances—A New GATT Working Group is Established. *Journal of World Trade* 23: 99–108.

Scherr, S. J. 1987. Hazardous Exports: U.S. and International Policy Development. In C. Pearson (ed.), *Multinational Corporations, Environment, and the Third World*. Durham, NC: Duke University Press.

———. 1985. Spatial Aspects of Environmental Economics. In A. Kneese and J. Sweeney (eds.), *Handbook of Natural Resource and Energy Economics*. New York: North Holland.

Singer, H. 1950. The Distribution of Gains between Investing and Borrowing Countries. *American Economic Review* 40: 473–486.

Ulph, A. 1994. Environmental Policy and International Trade—A Survey of Recent Economic Analysis. Working Paper 53. 94. Fondazione Eni Enrico Mattei, Venice, Italy.

Ulph, A., and D. Ulph. 1994. Trade, Strategic Innovation, and Strategic Environmental Policy—A General Analysis. Discussion Paper I, Economics and Econometrics 9416. Southhampton, U.K.: University of Southhampton.

3.4. Aid

Bauer, P. 1971. Dissent on Development: Studies and Debates in Development Economics. London, U.K.: Weidenfeld and Nicolson.

———. 1984. *Reality and Rhetoric*. London, U.K.: Weidenfeld and Nicolson.

Bayalama, S. 1994. Environmental Degradation, World Bank Projects, and the Right to a Clean Environment. In G. Shepherd Jr. and N. M. Konko (eds.), *Economic Justice in Africa:*

Adjustment and Sustainable Development. Studies in Human Rights 16. Westport, CT: Prager.

Beckerman, W. 1992. Economic Growth and the Environment: Whose Growth? Whose Environment? *World Development* 20: 481–496.

Cassen, R., and others. 1994. *Does Aid Work? Report to an Intergovernmental Task Force* (2nd ed.). Oxford, U.K.: Clarendon Press.

Connolly, B., and R. Keohane. 1996. Institutions for Environmental Aid: Politics, Lessons, and Opportunities. *Environment* 38(5): 12–27.

Daly, H. 1996. *Beyond Growth: The Economics of Sustainable Development.* Boston, MA: Beacon Press.

Griffin, K., and J. Enos. 1970. Foreign Assistance: Objectives and Consequences. *Economic Development and Cultural Change* April: 313–337.

Hansen, J. and S. Hansen. 1998. Integrating Environmental Concerns Into Economy-Wide Policies in Developing Countries: The Role of Multilateral Banks." *Environment and Development Economics* 4(1): 45-68.

Jordan, A. 1994. Financing the UNCED Agenda: The Controversy over Additionality. *Environment* 36: 16–34.

Korten, F. 1994. Questioning the Call for Environmental Loans: A Critical Examination of Forestry Lending in the Philippines. *World Development* 22: 971–981.

Larsen, B., and A. Shah. 1992. Combating the "Greenhouse Effect. " *Finance and Development* 29: 20–23.

Mikesell, R. 1992. *Economic Development and the Environment: Comparison of Sustainable Development with Conventional Development Economics.* New York: Mansell Publishing Limited.

Mikesell, R., and L. Williams. 1992. *The International Banks and the Environment: From Growth to Sustainable Development—An Unfinished Agenda.* San Francisco, CA: Sierra Club Books.

Moore, D. 1998. Many World Bank Projects Haunted by Grand Delusions. *Forum for Applied Research and Public Policy* 13: 26–31.

Mosley, P. 1987. *Foreign Aid: Its Defense and Reform.* Lexington, KY: University Press of Kentucky.

Oates, W. 1990. Reflections on an "Optimal Treaty" for the Global Commons Involving Industrialized and Developing Nations. Paper presented at the New Haven Workshop on Economics and Global Change. New Haven, CT: Yale University.

Parson, E., and A. Zeckhauser. 1995. Cooperation in the Unbalanced Commons. In K. Arrow and others (eds.), *Barriers to Conflict Resolution.* New York: Norton.

Reid, W., and J. Goldenberg. 1998. Developing Countries Are Combating Climate Change. *Energy Policy* 26: 233–237.

Rich, B. 1994. *Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development.* Boston, MA: Beacon Press.

Riddell, R. 1987. *Foreign Aid Reconsidered.* Baltimore, MD: Johns Hopkins University Press.

Tobey, J. 1993. Toward a Global Effort to Protect the Earth's Biological Diversity. *World Development* 21: 1931–1945.

World Bank. 1993. *The World Bank and the Environment.* Washington, DC: The World Bank.

———. 1997. The Impact of Environmental Assessment: A Review of World Bank Experience. Technical Paper 363. Washington, DC: World Bank.

3.5. Debt

Atkeson, A. 1991. International Lending with Moral Hazard and Risk of Repudiation. *Econometrica* 59: 1069–1089.

Bulow, J., and K. Rogoff. 1991. Sovereign Debt Repurchasing: No Cures for Overhang. *Quarterly Journal of Economics* 106: 1219–1235.

Capistrano, A., and C. Kiker. 1990. Global Economic Influences on Tropical Closed Broadleaved Forest Depletion, 1967–1985. Gainesville, FL: University of Florida, Food and Resource Economics Department.

Deacon, R., and P. Murphy. 1997. The Structure of an Environmental Transaction: The Debt-for-Nature Swap. *Land Economics* 73: 1–24.

Eaton J. and M. Gersovitz. 1981. Debt with Potential Repudiation: Theoretical and Empirical Analysis. *Review of Economic Studies* 48: 289–309.

Eaton J. and others. 1986. The Pure Theory of Country Risk. *European Economic Review* 30: 481–513.

Hansen, S. 1989. Debt for Nature Swaps: Overview and Discussion of Key Issues. *Ecological Economics* 1: 77–93.

———. 1990. Macroeconomic Policies: Incidence on the Environment. ODI Conference on: The Environment, Development of Economic Research. London, U.K., March 1990.

Hrynik, T. 1991. Debt for Nature Swaps: Effective but Not Enforceable. *Case Western Reserve Journal of International Law* 22: 141–163.

Krugman, P. 1988. Market-Based Debt-Reduction Schemes. National Bureau of Economic Research Working Paper 2587. NBER, Cambridge, MA.

———. 1990. Financing vs. Forgiving a Debt Overhang. *Journal of Development Economics* 29: 253–268.

Pearce, D., and J. Warford. 1993. *World without End: Economics, Environment, and Sustainable Development*. Oxford, U.K.: Oxford University Press.

Pearce, D., N. Adger, D. Maddison, and D. Moran. 1995. Debt and the Environment. *Scientific American* 272: 52–56.

Pinstrup-Anderson, P., M. Jaramillo, and F. Stewart. 1987. The Impact on Government Expenditure. In Cornia, G., R. Jolly, and F. Stewart. (eds.), *Adjustment with a Human Face*. Oxford, U.K.: Clarendon.

Reed, D. 1992. *Structural Adjustment and the Environment*. Boulder, CO: Westview Press for World Wide Fund for Nature International.

Sachs, J. 1988. Conditionality, Debt Relief, and the Developing Country Debt Crisis. NBER Working Paper 2644. NBER, Cambridge, MA..

———. 1989. A Strategy for Efficient Debt Reduction. *Journal of Economic Perspectives* 4: 19–29.

Sher, M. 1993. Can Lawyers Save the Rain Forest? Enforcing the Second Generation of Debt-for-Nature Swaps. *Harvard Environmental Law Review* 17: 151–224.

3.6. Structural Adjustment

Askari, H., and T. J. Cummings. 1976. *Agricultural Supply Responses: A Survey of Econometric Evidence.* New York: Praeger Press.

Bale, M., and E. Lutz. 1981. Price Distortions in Agriculture and Their Effects: An International Comparison. *American Journal of Agricultural Economics* 63: 8–22.

Berg, E. 1986. *Economic Issues in Fertilizer Subsidies in Developing Countries.* Background Paper for the World Development Report 1986. Washington, DC: World Bank.

Cleaver, K. 1985. The Impact of Price and Exchange Rate Policies on Agriculture in Sub-Saharan Africa. World Bank Staff Working Paper 728. Washington, DC: World Bank.

Cornia, G., and others. 1987. *Adjustment with a Human Face: Protecting the Vulnerable and Promoting Growth.* A Study by UNICEF, Vol. I. Oxford, U.K.: Clarendon Press.

———. 1988. *Adjustment with a Human Face: Ten Country Case Study.* A Study by UNICEF, Vol. II, Oxford, U.K.: Clarendon Press.

Dasgupta, P., and K.-G. Mäler. 1994. Poverty, Institutions, and the Environmental-Resource Base. Environment Paper 9. Washington, DC: World Bank.

Duriappah, A. 1998. Poverty and Environmental Degradation: A Review and Analysis of the Nexus. *World Development* 26: 2169–2179.

Freeman, A., T. Roe, and J. Smith. 1997. The Effects of Policies on Farming Households' Decisions: Economic Evidence and Environmental Implications in Northern Nigeria. *Environment and Development Economics* 2: 307–321.

Glover, D. 1995. Structural Adjustment and the Environment. *Journal of International Development* 7: 285–289.

Holden, S., J.E. Taylor and S. Hampton. 1998. "Structural Adjustment and Market Imperfections: A Stylized Village Economy-Wide Model with Non-Separable Farm Households." *Environment and Development Economics* 4(1): 69-87.

Jagannathan, N. 1990. Poverty-Environment Linkages: Case Study of West Java. Working Paper 1990-8. Washington, DC: World Bank, Environment Department. Processed.

Jagannathan, N., and A. Agunbiade. 1990. Poverty Environment Linkages in Nigeria: Issues for Research. Working Paper 1990-7. Washington, DC: World Bank, Environment Department. Processed.

Kothari, M., and A. Kothari. 1993. Structural Adjustment vs. Environment. *Economic and Political Weekly* 28: 473–477.

Leonard, H. 1989. *Environment and the Poor: Development Strategies for a Common Agenda.* U.S. Third World Policy Perspectives 11. Washington, DC: Overseas Development Council.

Mosely, P., J. Harrigan, and J. Tage. 1991. *Aid and Power: The World Bank and Policy-Based Lending.* London, U.K.: Routledge.

Munasinghe, M., and W. Cruz. 1995. *Economywide Policies and the Environment: Lessons from Experience.* Environment Paper 10. Washington, DC: The World Bank.

Pearce, D., and J. Warford. 1993. *World without End: Economics, Environment, and Sustainable Development.* Oxford, U.K.: Oxford University Press for The World Bank.

Reed, D. 1992. *Structural Adjustment and the Environment.* Boulder, CO: Westview Press for World Wide Fund for Nature International.

Repetto, R. 1985. *Paying the Price: Pesticide Subsidies in Developing Countries.* Washington, DC: World Resources Institute.

———. 1986. *Skimming the Water: Rent-Seeking and the Performance of Public Irrigation Systems.* Washington, DC: World Resources Institute.

Shively, G. 1998. Economic Policies and the Environment: The Case of Tree Planting on Low Income Farms in the Philippines. *Environment and Development Economics* 3: 83–104.

Spears, J. 1980. Can Farming and Forest Coexist in the Tropics? *Unasylva* 32: 128.

Stone, R., and E. Hamilton. 1991. *Global Economics and the Environment: Toward Sustainable Rural Development in the Third World.* New York: Council on Foreign Relations.

Woodward, D. 1992. *Debt Adjustment and Poverty in Developing Countries* (Vols. 1 and 2). New York: St. Martin's Press.

Young, E., and J. Bishop. 1995. Adjustment Policies and the Environment: A Critical Review of the Literature. Consortium for Research on Environment and Development (CREED) Working Paper Series 1. London, U.K.: International Institute for Environment and Development.

3.7. Population

Ahmad, M., and G. P. Krutcher. 1992. *Irrigation Planning with Environmental Considerations: A Case Study of Pakistan's Indus Basin.* World Bank Technical Paper 166. Washington, DC: World Bank.

Bilsborrow, R. 1992. *Rural Poverty, Migration, and the Environment in Developing Countries: Three Cases Studies.* Background Paper, World Development Report 1992 (WPS 1017). Washington, DC: World Bank.

Bilsborrow, R., and M. Geores. 1994. Change and Agriculture Intensification in Developing Countries. In L. Arizpe, M. P. Stone, and D. C. Major (eds.), *Population and Environment: Rethinking the Debate*. Boulder, CO: Westview Press.

Binswanger, H. 1987. *Fiscal and Legal Incentives with Environmental Effects on the Brazilian Amazon*. Washington, DC: The World Bank, Agricultural and Rural Development Center.

———. 1989. Brazilian Policies that Encourage Deforestation in the Amazon. Working Paper 16. Washington, DC: World Bank, Environment Department. Processed.

Birdsall, N. 1988. Economic Approaches to Population Growth. In H. B. Chenery and T. N. Srinivasan, *Handbook of Development Economics*. Amsterdam, the Netherlands: Elsevier Science Publishers.

Boserup, E. 1965. *The Conditions of Agricultural Growth*. Chicago, IL: Aldine.

———. 1981. *Population and Technological Change*. Chicago, IL: University of Chicago Press.

Brokenshaw, D. 1983. Community-Based Natural Resource Management. In D. Berry and B. Thomas (eds.), *Natural Resource Management Workshop: Collected Papers*. Worcester, MA: Clark University, Institute for Development Anthropology. Browder, J. O. 1989. Development Alternatives for Tropical Rain Forests. In J. Leonard (ed.), *Environment and the Poor: Development Strategies for a Common Agenda*. U.S.-Third World Policy Perspectives 11. Washington, DC: Overseas Development Council.

Brown, L. R. 1981. World Population Growth, Soil Erosion, and Food Security. *Science* 124: 995–1002.

———. 1984. Securing Food Supplies. In L. R. Brown and others (eds.), *State of the World 1984*. New York: W. W. Norton.

Bunker, S. 1994. Problems of Population and Environment in Extractive Economies. In L. Arizpe, M. P. Stone, and D. C. Major (eds.), *Population and Environment: Rethinking the Debate*. Boulder, CO: Westview Press.

Campbell, T. 1989. Urban Development in the Third World: Environmental Dilemmas and the Urban Poor. In J. Leonard (ed.), *Environment and the Poor: Development Strategies for a Common Agenda*. U.S.-Third World Policy Perspectives 11. Washington, DC: Overseas Development Council.

Cleaver, K. M., and G. A. Schreiber. 1993. *The Population, Agriculture, and Environment Nexus in Sub Saharan Africa.* Agriculture and Rural Development Series 9. Washington, DC: World Bank.

Council on Environmental Quality and the U.S. Department of State. 1980. *The Global 2000 Report to the President*. Washington, DC: U.S. Government Printing Office.

Coxhead, I. A., and Jayasuriya, S. 1994. Technical Change in Agriculture and Land Degradation in Developing Countries: A General Equilibrium Analysis. *Land Economics* 70: 20–37.

Dasgupta, P. 1992. Population, Resources, and Poverty. *Ambio* 21: 95–101.

DeBoer, A. J. 1989. Sustainable Approaches to Hillside Agriculture. In J. Leonard (ed.), *Environment and the Poor: Development Strategies for a Common Agenda*. U.S.-Third World Policy Perspectives 11. Washington, DC: Overseas Development Council.

Dover, M., and B. Croft. 1984. *Getting Tough: Public Policy and Management of Pesticide Resistance*. Washington, DC: World Resources Institute.

Ehrlich, P. R. 1968. *The Population Bomb*. New York: Ballantine.

Ehrlich, P. R., and A. H. Ehrlich. 1990. *The Population Explosion*. New York: Simon and Schuster.

International Organization of Consumers Unions, Regional Office for Asia and the Pacific. 1985. *The Pesticide Poisoning Report*. Penang, Malaysia.

Johnson, D. G., and R. D. Lee (eds.). 1987. *Population Growth and Economic Development: Issues and Evidence*. Madison, WI: University of Wisconsin Press.

Joshi, P. K. 1987. Effect of Surface Irrigation on Land Degradation: Problems and Strategies. *Indian Journal of Agricultural Economics* 42: 416–423.

Kelly, A. C. 1988. Economic Consequences of Population Change in the Third World. *Journal of Economic Literature* 26: 685–728.

Lele, U., and S. W. Stone. 1989. Population Pressure, the Environment, and Agricultural Intensification: Variations on the Boserup Hypothesis. MADIA Discussion Paper 4. Washington, DC: World Bank.

Mahar, D. 1989. Deforestation in Brazil's Amazon Region: Magnitude, Rate, and Causes. In G. Schramm and J. Warford (eds.), *Environmental Management and Economic Development*. Baltimore, MD: Johns Hopkins University Press for the World Bank.

Malthus, T. R. 1798. *An Essay on the Principle of Population, as It Affects the Future Improvement of Society. With Remarks on the Speculations of Mr. Goodwin, M. Condorcet, and Other Writers*. London, U.K.: J. Johnson.

McNamara, R. S. 1973. *One Hundred Countries, Two Billion People: The Dimensions of Development*. New York: Praeger Press.

———. 1992. The Population Explosion. *Futurist* 26: 9–13.

Meadows, D. H., D. L Meadows, J. Randers, and W. W. Behrens III. 1972. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.

Mink, S. 1993 Poverty, Population, and the Environment. Discussion Paper 189. Washington, DC: World Bank.

Mortimore, M. 1989. The Causes, Nature, and Rate of Soil Degradation in the Northernmost States of Nigeria. Working Paper 17. Washington, DC: World Bank, Environment Department.

Mortimore, M., and M. Tiffen. 1994. Population Growth and a Sustainable Environment: The Machakos Story. *Environment* 36: 10–20, 28–32.

Murdoch, W. W. 1980. *The Poverty of Nations: The Political Economy of Hunger and Nations*. Baltimore, MD: Johns Hopkins University Press.

Murray, D. L., and P. Hoppin. 1992. Recurring Contradictions in Agrarian Development: Pesticide Problems in Caribbean Basin Non-traditional Agriculture. *World Development* 20: 597–608.

Myers, N. 1991. The World's Forests and Human Populations: The Environmental Interconnections. In K. Davis and M. Bernstam (eds.), *Resources, Environment, and*

Population: Present Knowledge, Future Options. The Population Council, New York: Oxford University Press.

———. 1993. Population, Environment, and Development. *Environmental Conservation* 20(3): 205–216.

National Research Council. 1986. *Population Growth and Economic Development: Policy Questions*. Working Group on Population Growth and Economic Development, Committee on Population, Commission on Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Palloni, A. 1994. The Relation between Population and Deforestation: Methods for Drawing Causal Inferences from Macro and Micro Studies. In L. Arizpe, M. P. Stone, and D. C. Major (eds.), *Population and Environment: Rethinking the Debate*. Boulder, CO: Westview Press.

Panayotou, T. 1996. An Inquiry into Population, Resources, and Environment. In D. Ahlburg, and others (eds.), *The Impact of Population Growth on Well-Being in Developing Countries*. New York: Springer.

Pearce, D., and J. Warford. 1993. *World without End: Economics, Environment, and Sustainable Development*. Oxford, U.K.: Oxford University Press for The World Bank.

Pieri, C. 1993. Soil Fertility Management for Intensive Agriculture in the Humid Tropics. In J. Srivastava and H. Alderman (eds.), *Agriculture and Environmental Challenges: Proceedings of the 13th Agricultural Sector Symposium*. Washington, DC: World Bank.

Pimentel, D. 1993. *World Soil Erosion and Conservation*. Cambridge, U.K.: Cambridge University Press.

Pingali, A., and H. Binswanger. 1984. Population Density and Agricultural Intensification: A Study of the Evolution of Technologies in Tropical Agriculture. Report ARU 22. Washington, DC: World Bank, Agriculture and Rural Development Department. Processed.

Pino, J. A., and M. S. Strauss. 1987. The Preservation of Germplasm. In *Sustainability Issues in Agricultural Development: Proceedings of the 7th Agricultural Sector Symposium*. Washington, DC: World Bank.

Repetto, R. 1985. *Paying the Price: Pesticide Subsidies in Developing Countries*. Washington, DC.: World Resources Institute.

Repetto, R., and M. Gillis (eds.). 1988. *Public Policies and the Misuse of Forest Resources*. Cambridge, U.K.: Cambridge University Press.

Roberts, R. 1994. Urbanization and Environment in Developing Countries: Latin America in Comparative Perspective. In L. Arizpe, M. P. Stone, and D. C. Major (eds.), *Population and Environment: Rethinking the Debate*. Boulder, CO: Westview Press.

Rogers, P. 1993. Population and Environmental Deterioration: A 20-Year Retrospective. Center for Economic Policy Studies Discussion Paper 15. Morrilton, AR: Winrock International Institute for Agricultural Development.

Sen, A. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford, U.K.: Oxford University Press.

Shukla, V., and J. Parikh. 1996. Urbanization, Energy Use, and Greenhouse Effects in Economic Development: Results from a Cross National Study of Developing Countries. In V. Shukla (ed.). *Urbanization and Economic Growth*. Oxford, U.K.: Oxford University Press.

Simon, J. L. 1986. *Theory of Population and Economic Growth*. New York: Blackwell.

———. 1990. *Population Matters: People, Resources, Environment, and Immigration*. New Brunswick, NJ: Transaction Publishers.

Smil, V. 1984. *The Bad Earth: Environmental Degradation in China*. Armonk, NY: Sharpe.

Stoorvogel, J. J., and E. M. A. Smaling. 1990. *Assessment of Soil Nutrient Depletion in Sub-Saharan Africa: 1983–2000*. Report 28, Vol. 1. Wageningen, the Netherlands: The Winand Staring Center.

Tiffen, M., M. Mortimore, and F. Gichuki. 1994. *Population Growth and Environmental Recovery: Policy Lessons from Kenya*. Gatekeepers Series 45. London, U.K.: International Institute for Environment and Development.

Walker, D. J. 1982. A Damage Function to Evaluate Erosion Control Economics. *American Journal of Agricultural Economic* 64: 690–698.

3.8. Objectives

Alfsen, H. T. Bye, and L. Lorentson. 1987. *Natural Resource Accounting and Analysis: The Norwegian Experience 1978–1986*. Oslo, Norway: Norway Central Bureau of Statistics.

Asheim, G. 2000. Green National Accounting: Why and How?" *Environment and Development Economics* 5(1&2): 25-48.

Barde, J.-P., and D. Pearce. 1991. *Valuing the Environment: Six Case Studies*. London, U.K.: Earthscan.

Bartelmus, P. 1992. Accounting for Sustainable Growth and Development. *Structural Dynamics* 3(2): 241–260**.**

Bartelmus, P., and J. van Tongeren. 1993. Selected Issues in Integrated Environmental-Economic Accounting. In A. Franz and C. Stahmer (eds.), *Approaches to Environmental Accounting, Proceedings of the IARIW Conference on Environmental Accounting*, Baden Austria, May 27–29 1991. Heidelberg, Germany: Physica-Verlag.

Brundtland, G., and others. 1987. *Our Common Future: Report by the World Commission on Environment and Development*. New York: Oxford University Press.

Carabias J. and others. 1991. Las Cuentas del Patrimonio Natural del Corredor Biológico del Chichinautzin, Estado de Moralos, México. In *Inventarios y Cuentas del Patrimonio Natural en América Latina y el Caribe*. Santiago, Chile: United Nations Economic Commission for Latin America and the Caribbean.

Daly, H. 1989. Toward a Measure of Sustainable Social Net National Product. In Y. Ahmad, S. El Serafy, and E. Lutz (eds.), *Environmental Accounting for Sustainable Development*. Washington, DC: World Bank.

Dasgupta, P., and K.-G. Mäler. 1991. The Environment and Emerging Development Issues. *Proceedings of the World Bank Annual Conference on Development Economics 1990*. Washington, DC: World Bank.

Dreze, J., and A. Sen. 1989. *Hunger and Public Action.* WIDER Studies in Development Economics. New York: Oxford University Press.

El Serafy, S. 1989. The Proper Calculation of Income from Depletable Natural Resources. In Y. Ahmad, S. El Serafy, and E. Lutz (eds.), *Environmental Accounting for Sustainable Development*. Washington, DC: World Bank.

Gilbert, A. 1990. Natural Resource Accounting: A Case Study of Botswana. In J. Dixon, D. James, and P. Sherman (eds.), *Dryland Management: Economic Case Studies*. London, U.K.: Earthscan.

Hicks, J. 1946. *Value and Capital* (2nd ed.). Oxford, U.K.: Clarendon Press.

Hueting, R. 1980. *New Scarcity and Economic Growth.* Amsterdam, the Netherlands: North Holland.

———. 1989. Correcting National Income for Environmental Losses: Towards a Practical Solution. In Y. J. Ahmad, S. El Serafy, and E. Lutz (eds.), *Environmental Accounting for Sustainable Development*. Washington, DC: The World Bank.

Pearce, D., and J. Warford. 1993. *World without End: Economics, Environment, and Sustainable Development.* Oxford, U.K.: Oxford University Press for The World Bank.

Pearce, D., A. Markandya, and E. Barbier. 1990. Environmental Sustainability and Cost-Benefit Analysis. *Environment and Planning* 22: 1259–1266.

Peskin, H. 1988. *Environmental and Non-market Accounting in Indonesia.* A Report for the Environmental Sector Review (Phase II), Jakarta. Silver Spring, MD: Edgevale Associates.

Peskin, H., with E. Lutz. 1990. A Survey of Resource and Environmental Accounting in Industrialized Countries. Environment Department Working Paper 37. Washington, DC: World Bank.

Repetto, R. 1989. Economic Incentives for Sustainable Production. In G. Schramm and J. Warford (eds.), *Environmental Management and Economic Development*. Baltimore, MD: Johns Hopkins University Press.

Repetto, R., and others. 1989. *Wasting Assets: Natural Resources in the National Income Accounts*. Washington, DC: World Resources Institute.

Sejenovich, H., and others. 1991. Las Cuentas del Patrimonio Natural de un Ecosistema Andino-Patagónico de la Provincia de Rio Negro, Argentina. In *Inventarios y Cuentas del Patrimonio Natural en América Latina y el Caribe*. Santiago, Chile: United Nations Economic Commission for Latin America and the Caribbean.

Sen, A. 1983. Poor Relatively Speaking. *Oxford Economic Papers* 35(1): 153–169.

Solarzano A. and others. 1991. *Accounts Overdue: Natural Resource Depletion in Costa Rica.* Washington, DC: World Resources Institute.

Stewart, F. 1985. *Planning to Meet Basic Needs.* London, U.K.: Macmillan.

Streeton, P. 1984. Basic Needs: Some Unsettled Questions. *World Development* 12(9): 373–379.

Theys, J. 1989. Environmental Accounting in Development Policy. The French Experience. In Y. Ahmad, S. El Serafy, and E. Lutz (eds.), *Environmental Accounting for Sustainable Development*. Washington, DC: World Bank.